SECTION 01015

TECHNICAL REQUIREMENTS – DESIGN/BUILD

1.0 GENERAL

1.1 COMPLIANCE

The Contractor's design and construction must comply with technical requirements contained herein. The Contractor shall provide design and construction using the best blend of cost, construction efficiency, system durability, ease of maintenance and environmental compatibility.

1.2 MINIMUM & ALTERNATE REQUIREMENTS

The design and product requirements stated in these documents are minimum requirements. Exceeding the minimum requirements as improvements to the design stated herein is highly encouraged at no additional cost and as approved by the government. The technical requirements listed in Codes and Technical Criteria, Section 1.8, apply to this project. Any deviation from the technical requirements shall be approved by the Contracting Officer. Request for deviations shall be submitted for approval. The Contractor is encouraged to propose alternate design or products (equipment and material) that are more commonly used in the region; but these variations shall be equal in performance from a technical standpoint as well as more cost effective or allow for more timely completion. Variations shall furnish the same system safety, durability, ease of maintenance and environmental compatibility. The Contractor will be required to submit information as specified in Section 01335, 3.6.4 Variations, for all proposed variations with which to make a comprehensive comparison of the proposed alternate. All variations of approved designs must be approved by the Contracting Officer.

1.3 ASBESTOS CONTAINING MATERIALS

Asbestos containing material (ACM) shall not be used in the design and construction of this project. If no other material is available which will perform the required function or where the use of other material would be cost prohibitive, a waiver for the use of asbestos containing materials must be obtained from the Contracting Officer.

1.4 SAFETY

1.4.1 UNEXPLODED ORDNANCE (UXO)

It is the responsibility of the Contractor to be aware of the risk of encountering UXO/mines and to take all actions necessary to assure a safe work area to perform the requirements of this contract. If during construction, the contractor becomes aware of or encounters UXO/mines or potential UXO/mines, the contractor shall immediately notify the COR, mitigate any delays to scheduled or unscheduled contract work, and clear/remove the UXO/mines. The contractor may only provide clearance/removal services via UNMACA accredited entities. Clearance/removal may only be undertaken in accordance with IMAS/AMAS/USACE standards. The Contractor assumes the risk of any and all personal injury, property damage or other liability arising out of or resulting from any Contractor action taken hereunder. Scrap metal shall be the property of the contractor to dispose of or salvage as directed by the Contracting Officer's Representative.

NOTE: For previous UXO/mine information, and a copy of the clearance certification the following points of contact from the UN Mine Action Center of Afghanistan are provided:

Mohammad Sediq, Chief of Operations,
Email: sediq@unmaca.org

Cell: +93 070 295207

Hansie Heymans, Chief Information Officer,
Email: hansie@unmaca.org
Cell: +93 070 294286

1.4.2 UNEXPLODED ORDNANCE (UXO) SAFETY SUPPORT DURING CONSTRUCTION.

It is the responsibility of the Contractor to be aware of the risk of encountering UXO and to take all actions necessary to assure a safe work area to perform the requirements of this contract. If after the entire site has been cleared of UXO/mines per the International Mine Action Standards (IMAS) and clearance is done to the anticipated foundation depth, the Contractor becomes aware of or encounters UXO or potential UXO during construction, the Contractor shall immediately stop work at the site of the encounter, move to a safe location, notify the COR and Mine clearance Contractor/ Mine clearance Sub-Contractor, and mitigate any delays to scheduled or unscheduled contract work. The Mine clearance Contractor/ Mine clearance Sub-Contractor shall remove and dispose of UXO's per the International Mine Action Standards (IMAS). These standards can be found at http://www.mineactionstandards.org. The Contractor assumes the risk of any and all personal injury, property damage or other liability arising out of and resulting from any Contractor action hereunder. In these cases the contractor shall be required to identify and dispose of the ordnance.

1.5 LIMITATION OF WORKING SPACE

The Contractor shall, except where required for special reasons, confine his operations strictly within the boundaries of the temporary construction limits as required in Paragraph 2.1.4. Workmen will not be permitted to trespass on adjoining property. Any operations or use of space outside these boundaries shall be by arrangement with all interested parties. It must be emphasized that the Contractor must take all practical steps to prevent his workmen from entering adjoining property and in the event of trespass occurring the Contractor will be held entirely responsible.

The construction area and surroundings are likely to contain mines and unexploded ordnance (UXO). Contractors assume all risks of damage, injury or death when working on or around the project site.

1.6 TEMPORARY STRUCTURES

The Contractor shall erect suitable temporary fences, lighting, and necessary structures to safeguard the site, materials, and plant against damage or theft and for the protection of the general public and shall adequately maintain the same throughout the course of the contract.

1.7 SUBCONTRACTORS

Compliance with the provisions of this section by subcontractors will be the responsibility of the contractor.

1.8 LIST OF CODES AND TECHNICAL CRITERIA:

The following codes and technical criteria and those referenced therein shall be required for this project. References within each reference below shall be required and adhered to. If there is conflict in the criteria the most stringent requirement shall be applied. This list is not exclusive and is not necessarily complete. The publications to be taken into consideration shall be those of the most recent editions.

Ministry of Rural Rehabilitation and Development (MRRD)

MRRD Standard Drawings

Ministry of Public Works (MPW) Standards

AASHTO American Association of State Highway and Transportation Officials

AASHTO Green Book – A policy on Geometric Design of Highways and Streets

AASHTO LRFD Bridge Design Specifications

AASHTO Manual on Uniform Traffic Control Devices

AASHTO Model Drainage Manual

American Concrete Institute

ACI 301M Specifications for Structural Concrete

ACI 318 Building Code Requirements for Structural Concrete

ACI 530/ASCE 5/TMS 402, Building Code Requirements for Masonry Structures

American Institute of Steel Construction

AISC 325 Steel Construction Manual, American Institute of Steel Construction

American Society of Civil Engineers

ASCE 7, Minimum Design Loads for Buildings and Other Structures

American Society of Testing and Materials

ASTM - American Society for Testing and Materials

American Welding Society

AWS D1.1, Structural Welding Code – Steel

National Fire Protection Association

NFPA 1, General Fire Protection

NFPA 1141, Site Fire Protection

United Nations

International Mine Action Standards, latest edition; (see http://www.mineactionstandards.org for copy of standards)

United States Army Corps of Engineers

TM 5-785 Weather Data

TM 5-802-1 Economic Studies

EM 1110-3-136 Drainage and Erosion Control – Mobilization Construction

EM 1110-2-1902 Slope Stability

FM3-34.343-AppB

United Facilities Guide

UFC 1-300-07A Design Build Technical Requirements

UFC 3-220-03FA Soils and Geology

UFC 3-320-05FA Design: Structural Design Criteria for Structures Other than Buildings

UFC 3-230-17FA, Drainage in Areas Other than Airfields

UFC 3-250-09FA, Aggregate Surface Roads and Airfields Areas

UFC 3-250-18FA, General Provisions and Geometric Design for Roads, Streets, Walks and Open Storage Areas

UFC 1-301-01, Structural Engineering

United States Central Command

USCINCCENT OPORD 97-1

Overseas Environmental Baseline Guidance Document, Department of Defense, May 2007

United States Department of Transportation

Manual on Uniform Traffic Control Devices (MUTCD)

The publications to be taken into consideration shall be those of the most recent editions.

Unified Facility Criteria (UFC) is available online at http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

Engineering Manuals and other Corps of Engineers Publications are available online at: http://www.hnd.usace.army.mil/TECHINFO/engpubs.htm

In addition, technical criteria provided in USACE-AED Design Requirements (most recent version) shall be required for use in design and construction specifications as indicated in the following documents. The following design criteria shall be used:

AED Design Requirements – Hydrology, latest version

AED Design Requirements - Culvert and Causeway Design, latest version

AED Design Requirements - Vertical Curves, latest version

AED Design Requirements – Horizontal Curves & Super Elevation, latest version

AED Design Requirements – Geotechnical Investigations for USACE Projects, latest version

1.9 AED DESIGN REQUIREMENTS DOCUMENTS

AED Design Requirements documents (latest version) listed above shall be adhered to in this contract. These documents are available from the COR. These documents shall be used as the basis for design and construction, and for selecting options within the United Facilities Guide Specifications (UFGS). It is the contractor's option to use specifications contained in the AED Design Requirements Documents, when provided, or to adapt the UFGS specifications to match the requirements provided in the AED Design Documents and specifications. Site or project specific data and requirements in the AED Design Requirements documents shall supersede UFGS language where there are differing criteria which must be evaluated and selected.

1.10 ENVIRONMENTAL PROTECTION

1.10.1 APPLICABLE REGULATIONS

The Contractor shall comply with all Host Nation laws, rules, regulations or standards concerning environmental pollution control and abatement with regard to discharge of liquid waste into natural streams or manmade channels. The contractor shall review host nation and U.S. Government environmental regulations with the contracting officer prior to design and discharge of any liquid wastes into natural streams or manmade channels.

1.10.2 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed non-compliance with the foregoing provisions. The Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part

of the work until satisfactory corrective action has been taken. No extension of time or damages will be awarded to the Contractor unless it was later determined that the Contractor was in compliance.

1.10.3 SPILLAGES

Measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, waste washings, herbicides and insecticides, and construction materials from polluting the construction site and surrounding area.

1.10.4 DISPOSAL

Disposal of any materials, wastes, effluents, trash, garbage, oil, grease, chemicals, etc., shall be taken to a dumpsite off site and subject to the approval of the Contracting Officer. Burning at the project site for the disposal of refuse and debris will not be permitted.

2.0 CIVIL

2.1 ROADWAY

2.1.1 HORIZONTAL AND VERTICAL CONTROL

Universal Transverse Mercator Grid Zone 42 S, World Geodetic System (WGS84) and the elevation should be height above ellipsoid (WGS84) and sea level (EGM96). If there has been gravitational surveys performed nearby, these shall be noted. A survey database file for all features should show both ellipsoid height and geoid height and WGS84 latitude/longitude as well as UTM coordinates. WGS84 data shall be corrected to WGS84 (G1150) datum reference. GPS benchmarks shall be documented at ITRF2000 coordinates referenced to epoch 1997. Basic project control surveys will be performed using precise differential carrier-phase tracking Navstar GPS measurement procedures.
The Contractor shall submit raw GPS survey files in the RINEX format. The GPS files shall be submitted using the following naming convention for RINEX files: (ssssdddf.yyt)

ssss: 4-character station name designator

ddd: day of the year of first record

f: file sequence number within day

0: file contains all the existing data of the current day

yy: year

t: file type:

O: Observation file

N: Navigation file

M: Meteorological data file

G: GLONASS Navigation file

H: Geostationary GPS payload nav mess file

All of the control points established at the site shall be plotted at the appropriate coordinate point and shall be identified by name or number, and adjusted elevations. At least two control points shall be established as permanent survey monuments which will survive construction of this project. The location of the project site, as determined by the surveyor shall be submitted in writing to the Contracting Officer. The site location shall be identified by temporary markers, approved by the Contracting Officer before proceeding with the surveying work.

2.1.2 SURVEY AND EXISTING CONDITIONS MAP

The contractor shall prepare an Existing Conditions Map of the property/roadway right-of-way including a Boundary Survey. The survey shall show the property boundary along the alignment of the existing roadway and proposed bypass consisting of identifying all property corners, establishing horizontal and vertical control, listing all bearing and distances of property lines from all property corners, and curve

data, and tie-ins on every sheet (showing bearing and distance) from at least two (2) major offsite man-made or natural features. The contractor shall place one (1) steel pipe on the site to identify the primary reference point. On the Existing Conditions Map, the elevation, coordinate grid, and WGS 84 latitude and longitude of the pipe shall be shown. This survey shall meet the requirements of World Geodetic System 1984 (WGS 84 UTM Zone 42 S in decimal degrees). Existing roads shall be properly stationed and profiles of the centerline of existing road alignments shall be provided. The Existing Conditions Map shall be no less than 1:500 scale and shall include topographic information no less than 15 meters outward in each direction from the property lines with existing contour lines. If the terrain requires grading, blasting or deep fills, the survey and topographic information shall include the entire extents of the affected area plus 5 meters outward. All drainage areas affecting the roadway shall be surveyed with topographic information as well. The Existing Conditions Map shall show the locations of all on-site and nearby offsite existing features including but not limited to buildings, structures, streams (intermittent and perennial), rivers, washes/wadis, major trees, road pavements and connecting road pavement and right of ways, names of roads, widths of roads, easements, and existing underground and aboveground utilities etc. The topographic contour interval shall be no greater than 0.2 meter difference in elevation. In the event the terrain is so steep that contour lines with a 0.2 meters interval is illegible, a smaller scale drawing for that particular area shall be developed that shows the 0.2 meter contour lines legibly. Intermediate elevations shall be provided as necessary to show breaks in grade and changes in terrain. Spot elevations affecting design of facilities shall be provided. Specifically, break points or control points in grades of terrain such as tops of hills, bottoms of ditches and gullies, high bank elevations, top and toe of retaining walls, flowline and headwalls of existing culverts, etc.

A Structure Evaluation Report shall be created for existing Bridge SBK-1001. The report shall include descriptions including corner control point locations and elevations, length, height, materials, *etc*., and photos of the structural features which are to be reused.

2.1.3 ROADWAY PLAN & PROFILE

Based on the Boundary Survey and Existing Conditions Map a separate Roadway Plan & Profile shall be prepared in plan and profile sheet format at a scale no larger than 1:50 showing the property boundary and all proposed surface features including but not limited to the road, shoulder, culverts, swales, causeways, retaining walls, guard rails, location of signage, pavement markings etc. Any feature that cannot be legibly seen on the Roadway Plan shall have a detail made of that particular area. Shown on the Roadway Plan shall be proposed contour lines and how these proposed contour lines shall meet with existing contour lines. The contour interval shall be no greater than 0.2 meters difference in elevation. Also shown on the Roadway Plan shall be pertinent existing features (on-site and off-site) that will have an influence or impact on the development of the site. All site features shall be clearly defined and dimensioned on the Roadway Plan. The Roadway Plan shall be properly stationed and show complete geometric design of the road with a tables showing curve data. Centerline stationing shall be set at intervals of 10m. The Roadway Plan shall be drawn in the following projection and datum for incorporation into the U.S. Army Corps of Engineers GIS system:

WGS 1984 UTM Zone 42 S

2.1.4 CROSS SECTIONS, AND KEY MAP

Based on the survey, Existing Conditions Map and Roadway Plan & Profile, cross sections shall be generated at 10m intervals along the bypass road starting at the West intersection with Highway 1 and at 10m intervals along the road alignment and ending at East intersection with Highway 1. Additional cross sections shall be provided through any existing and proposed drainage structures and road features. These cross sections shall be obtained through the flowline of the drainage system and note the angle from the road centerline noted. Cross sections shall provide design slope angles for road bed and road drainage and design slopes for areas adjacent to the existing road alignment. Cross Sections drawings shall show the location and height of retaining walls.

A typical roadway cross-section shall include 1) pavement profile and ditch criteria; 2) cross slope; 3) roadway widths; 4) showing the back angles, the slope that must be constructed from the road, based on

material type; and 5) slopes tying into existing grade. Where appropriate, cross sections will show riprap armor to their fullest extent.

Based on the survey, Existing Conditions Map and Roadway Plan & Profile, cross sections shall be generated at along the wadi channel throughout the length project. Sections shall be taken at centerline of the bridge, at 10M and 20M north of the bridge, between the bridge and the culvert, and at the culvert.

A typical wadi channel cross-section shall include 1) bottom of the channel, 2) retaining wall location 3) slope embankments or bridge end slopes, and 4) slopes tying into existing grade. Cross sections will show riprap armor to their fullest extent.

An overall site key map that depicts project design area, including temporary construction limits, shall be provided.

2.1.5 DETAIL DRAWINGS

Detail drawings for ALL structures including but not limited to the bridge, box culvert, channel improvements, riprap armor, erosion control, open drainage ditching, gabion walls, retaining walls and other slope stability measures, signage, etc., shall be incorporated into the design.

2.1.6 DEMOLITION

Demolition shall include removal of the damaged bridge superstructure span, appurtenances affixed to the bridge superstructure, damaged bearings, damaged expansion joints, loose bridge debris, pavements, and utilities, and clearing and grubbing in the alignment of the existing road. Demolition shall include removal of sediment from the river channel where required for channel upgrades. All refuse and debris shall be disposed of off of the site. Coordinate disposal locations with the Contracting Officer. Holes and depressions shall be backfilled. Fill materials shall be composed of satisfactory soils or aggregates defined in ASTM D 2487 as GW, GP, GM, SP, SM, and SW. Minimum soil compaction shall be 95 percent of maximum density as defined in ASTM D 1557.

2.1.7 DESIGN DEVELOPMENT

2.1.7.1 GENERAL

Contractor is responsible for verifying information and quantities before bidding this project and shall design and construct the replacement bridge and drainage structures as specified in this RFP. The attachments indicate the approximate project limits. **Information provided in the attachments is for informational purposes only**. The Contractor is responsible for locating the proposed project limits.

The work within this contract shall meet and be constructed in accordance with the Ministry of Rural Rehabilitation and Development (MRRD) and Ministry of Public Works (MPW) “Road and Highway Standards,” safety and security standards and other references as stated in this Section 01015 “Technical Requirements.” In the event of discrepancies between the contract documents and the MRRD/MPW Standards, the requirements of this contract take precedence.

2.1.7.2 CURRENT CONDITIONS

Bridge SBK-1001 is currently bypassed on the immediate South by traffic going down the banks and across the dry wadi. The bridge was built in 2004 and consists of two approximately 14.375-meter simple spans on abutments and a reinforced concrete interior bent. The bridge alignment is normal to the tangent part of the road and has a bearing of approximately N 86° E. The superstructure supports are four (4) cast-in-place reinforced concrete stems with a 210-mm cast-in-place reinforced deck slab 8.20-m wide at inside faces of curbs. The beam stems are 560 mm X 660 mm. 200 mm wide and full-depth concrete diaphragms are present at thirds parallel to bents. 300-mm wide X 300-mm high concrete parapets are cast on deck overhang with varying thickness and hold the steel 2-pipe railings.

The bridge has blast damage in the West span between the North exterior beam and the next interior beam which penetrated the slab and collapsed the interior bent. The interior bent substructure and the superstructure have to be rebuilt completely.

2.1.7.3 END STATE

This work shall include the design and construction of a replacement bridge, new interior bent and bent footing [if required by Contractor's design], repairs to abutments, a downstream bypass with multi-cell box culvert, upgrades to the wadi channel and upgrades to the wadi banks. Damage to existing abutments, expansion joints, approach slabs, and roadway pavement shall be repaired with equal or better material. The approach roadway shall be graded for smooth transition to bridge wearing surface when the wearing surface elevation is higher than the existing elevation due to the thickness of the replacement bridge superstructure. Project limits shall take any required modifications of the approach roadway into consideration.

2.1.8 GENERAL DESIGN REQUIREMENTS

2.1.8.1 HORIZONTAL ALIGNMENT

The plans shall show the horizontal alignment for the existing road, to include the edge of the road surface and the edge of shoulder.

The horizontal alignment shall be labeled with the following as a minimum:

Tangents- Stations of Intersections with Highway 1
Bearing and distance of each segment

Curves - Point of Curve (PC) station
Point of Tangent (PT) station
Point of Intersection (PI)
PI Station
Deflection Angle
Tangent (T)
Length (L)
Deflection Angle (Delta)
Degree of Curve (Dc) – Shall not exceed 10 unless on a switchback, if in excess of 10, the minimum outer turning radius shall be 20m.
Radius (R)
Begin of Curve (BC)
End Curve (EC)

2.1.8.2 VERTICAL ALIGNMENT

Based on the survey, centerline profile drawings of the existing alignment shall be provided. Plan and profile views of project segments shall be shown on the same plan sheet. Detailed requirements for vertical alignment are listed as follows:

- The profiles shall show the vertical alignment for the finished road with the existing grade along this vertical alignment.
- The vertical profile shall be labeled with the following at a minimum:

Tangents- Percent of slope - Maximum grade 10%

Curves - Vertical Point of Intersection Station (VPI-S) - At an even meter stations
Vertical Point of Intersection Elevation (VPI-E)

Algebraic Difference (AD)
Rate of Curvature (K) – Shall meet AASHTO minimums
Curve Length (L) - In even meter increments
Begin Vertical Curve Station (BVC-S)
Bevin Vertical Curve Elevation (BVC-E)
End Vertical Curve Station (EVC-S)
End Vertical Curve Elevation (EVC-E)
Crest (high point) or Sag (low point) station & elevation

2.1.8.3 DESIGN VEHICLE AND DESIGN SPEED

The replacement bridge span shall be designed and constructed for two-way traffic with AASHTO HS20-44 vehicles and two-way NATO STANAG MLC 30 loads. It shall carry an average daily traffic volume up to 13,000 vehicles with 50% of the traffic load consisting of trucks.

Project geometry shall be based on a design vehicle classified AASHTO HS-20 and the design speed shall be 100 km/hr.

2.1.8.4 OVERHEAD CLEARANCE

A minimum overhead clearance of 6 meters clear of all obstructions shall be provided along the road. This clearance shall extend from top of shoulder to top or shoulder. Obstructions are any physical object within the space defined above to include trees, signs, electrical and communication lines, or suspended wire or cable of any type.

2.1.8.5 PAVEMENT STRUCTURE

The asphalt road section shall have a minimum of the following: 100-mm hot-mix asphalt pavement, placed above 100-mm thick aggregate base-course material compacted to 95% maximum proctor density, placed above aggregate subbase as defined in Section 32 11 16 shall be used to meet the required elevation for placement of the aggregate base course. Material gradation requirements shown in Appendix A shall be adhered to as a minimum standard for materials to be used in this project.

The roadway shall be marked with a white reflective dashed centerline and solid white reflective shoulder lines. The markings shall be 10 cm wide. Dashes shall be 3 meters long with 6-meter gaps between dashes.

In the event that the geotechnical investigation reveals that the pavement structure for the road surface and shoulder is insufficient to carry the design load, the Contractor shall design and construct a proper subgrade thickness by excavating and replacing with satisfactory materials in 150mm lifts compacted to 95% maximum dry density. Satisfactory materials shall be in accordance with Paragraph 2.2.3.1 of this Section.

2.1.8.6 STONE MASONRY

Stone masonry shall be fully mortared. No voids shall be permitted between stones. The median stone size shall be 10 kg. Larger stones may be used. Smaller stones shall be used to fill gaps between stones greater than 37.5 mm. Mortar shall conform to UFGS Section 04 29 00 type “M”. Mortar shall have a minimum f’m=17 MPa. Mortar shall have a minimum water retention of 75%.

2.1.8.7 RIPRAP

Riprap gradation:

W_{100}=20.0 kg	D_{100}=250 mm
W_{90} =10.0kg	D_{90}=200mm
W_{15}=1.25kg	D_{15}=100mm

All stone larger than D_{90} shall a minimum stone to stone contact of six points. Riprap surface tolerance shall not exceed 75mm. All voids between stones shall be completely filled with mortar through the entire thickness of stone masonry.

2.1.8.8 CUT-OFF WALLS

The concrete box culvert bypass shall be bounded by cut off walls for the entire length of the project. Cutoff walls shall have a minimum depth of 1 meter below the finished surface of the box culvert structure and shall be constructed with minimum dimensions as shown in Appendix A.

2.1.8.9 SCOUR APRONS

Scour aprons shall be constructed of fully-grouted riprap as shown in Appendix A. This gradation shall be adjusted to meet hydraulic requirements for armor stability of all events up to a 100-year return interval.

2.1.8.10 SITE GRADING AND DRAINAGE

The Contractor will provide all necessary drainage calculations, drainage design and grading to ensure adequate drainage of the area. Drainage of the area should be compatible with the existing terrain. The contractor shall use USGS topographic maps to delineate all watersheds and verify that all drainage areas are accounted for.

Rainfall data shall be based on data obtained from meteorological records collected in Afghanistan. National agencies may be consulted for data. In the absence of site-specific data, intensity-duration-frequency curves contained in the AED Design Requirements – Hydrology, most recent version shall be used by extrapolating the rainfall intensity information from the stations in closest proximity to the project. Under no circumstances will relationships developed by extrapolation from foreign countries be used for hydrologic studies.

2.1.8.11 CHANNEL UPGRADES

The existing river channel shall be upgraded in accordance with Appendix and the following requirements. Stone masonry aprons shall be installed on each side of the bypass culvert. The existing bridge abutment walls shall be extended to new bypass culvert to shore up banks. Rip rap shall be in the channel under the bridge with the 2 meters past North abutments as one limit and all the way down to the culvert and 5 meters on the South of the culvert as well.

2.1.8.12 CONSTRUCTION IN AN ACTIVE RIVER

Construct the bridge, channel upgrades and bypass during periods of zero flow as much as possible to minimize the effort required to divert the river from the project site. Any water diversion structures or systems used to manage water during construction shall be at the Contractor's expense. Any and all diversion structures or systems installed by the Contractor shall be removed and the river shall be returned to a free flowing state as a part of this project.

2.1.8.13 RIVER DIVERSION PLAN

The Contractor shall submit a plan for Government approval for managing the water in the wadi during construction prior to the commencement of any construction activities in the river. This plan shall demonstrate how earthwork and concrete placement shall be performed in the river when there is water flowing in the river and to remove groundwater during foundation installation. The plan will provide diagrams of any earthwork, sheet piles, cofferdams, pumping systems or other methods used to create a dry construction site. Calculations shall be provided for cofferdams. If pumping systems are to be employed, the Contractor shall provide appropriate pump and line specifications. If earthwork is to be used, the Contractor shall demonstrate how damage to project earthwork will be avoided.

2.2 GEOTECHNICAL

2.2.1 SOIL AND ROCK INVESTIGATION

Existing geotechnical information is not available at the project site. Any site-specific geotechnical data required to develop pavement structure, slope stability, foundations, materials, earthwork, and other geotechnical related design and construction activities for this project shall be the Contractor's responsibility. The Contractor shall develop all pertinent geotechnical design and construction parameters by appropriate field and laboratory investigations and analyses. The Contractor shall produce a detailed geotechnical report containing field exploration and testing results, laboratory testing results (particle sizes and distribution, liquid and plastic limit test, and moisture and density test, etc.). Information in the report shall include, but not limited to: existing geotechnical (e.g. surface and subsurface) conditions, location of subsurface exploration logs on site plan, exploration point, allowable soil bearing capacity and bridge foundation recommendations, bearing capacity, pavement design criteria (e.g. CBR values, K values), groundwater levels, and construction materials (e.g. concrete cement, and aggregates). For standard penetration test (SPT), the Contractor shall use ASTM D1586. All geotechnical laboratory and field work shall be based on standards set forth in the ASTM. Contractor shall not use any DIN standards for penetration tests in lieu of ASTM D 1586. Soil investigations shall conform to AED Design Requirements: Geotechnical Investigations for USACE Projects, latest version.

Conduct two sets of soil classification, particle distribution analysis and California Bearing Ratio (CBR) tests on the proposed bypass alignment (one on each side of the wadi). Results from the tests shall be used to calculate the pavement structure using the minimum pavement structure as stated in 2.1.8.5 as a reference. In the event that the calculations based on the CBR tests reveal that the pavement structure stated in 2.1.8.5 is insufficient to carry the design load, the Contractor shall remove the unsuitable material and replace it with suitable materials compacted to the minimum requirements as determined by the design.

One test boring that is no less than 10 m deep with soil samples taken every 3 meters and at the bottom of the test boring, shall be drilled at the location of new bridge footings and center of the bypass box culvert. For footing design, allowable soil bearing pressures shall be determined by calculations made based on the physical and mechanical properties obtained from laboratory testing.

The Contractor shall submit a geotechnical investigation plan prior to commencing any field investigation to the USACE-AES Engineering Branch through the COR for review and approval. Once the plan is reviewed and approved, the Contractor can start the field investigation. The Geotechnical Report shall be submitted with all the design review submittals as specified in the 01335. No design review submittal shall be considered complete without an approved geotechnical report. Geotechnical investigation plans and report of investigations shall be submitted promptly in accordance with Section 01335.

2.2.2 GEOTECHNICAL QUALIFICATIONS

A geotechnical engineer that is a member of a geotechnical firm responsible to the Contractor shall oversee all geotechnical engineering design parameters. The geotechnical engineer shall be qualified by: education in geotechnical engineering, AND professional registration; AND a minimum of ten (10) years of experience in geotechnical engineering design. The geotechnical firm conducting either the field

investigation or laboratory work shall be certified by the Chief, Quality Assurance Branch USACE-AES or Chief, Quality Assurance Branch-AEN. Certification document shall be submitted as part of the Geotechnical Report.

2.2.3 EARTHWORK AND FOUNDATION PREPARATION

2.2.3.1 SATISFACTORY MATERIALS

Any materials classified by ASTM D 2487 as GW, GP, GM, SW, SP, or SM and free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, or objectionable materials.

2.2.3.2 UNSATISFACTORY MATERIALS

Any materials which do not comply with the requirements set forth in the Satisfactory Materials paragraph. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 75mm. The Contracting Officer shall be notified of any unsatisfactory materials.

2.2.3.3 CLEARING AND GRUBBING

Unless indicated otherwise, remove tress, stumps, logs, shrubs, brush and vegetation, and other items that would interfere with construction operations. Remove stumps entirely. Grub out matted roots and roots over 50mm in diameter to at least 500mm below existing surface.

2.2.3.4 EXCAVATION AND COMPACTION OF FILL

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed. Refill with satisfactory material and compact to at least 95 percent of the maximum dry density, as determined by the Modified Proctor laboratory procedure. ASTM D 1557 shall be used for producing the Modified Proctor moisture-density curve, unless the soil to be compacted includes more than 30% retained on the 19 mm (3/4") sieve. In this case, the Contractor must replace the ASTM D 1557 laboratory compaction procedure with AASHTO T 180, Method D, corrected with AASHTO T 224.

During compaction, the moisture content of the soil shall be within 1.5 percent of the optimum moisture content, as determined by the Modified Proctor laboratory procedure. The thickness of compacted lifts shall not exceed 15 cm and the dry density of each compacted lift shall be tested by either sand cone (ASTM D 1556) or nuclear gage (ASTM D 2292). If the nuclear gage is used, it must first be compared to sand cone tests for each soil type to verify the accuracy of the nuclear gage measurements for moisture content, wet density, and dry density. Furthermore, every tenth nuclear gage test must be accompanied by a sand cone test and these verification data must be summarized and submitted to the Contracting Officer. Density tests shall be performed at a frequency of not less than one test for each 200 square meters and not less than two tests per compacted lift.

3.0 STRUCTURAL

All structures and appurtenances shall be designed and constructed in accordance with AED design requirements as described in earlier sections and shall be constructed following the standards listed below. The structural design shall include the design for the replacement and repair of damaged structures and appurtenances, and the design of new structures. The bridge foundation shall be buried and proportioned per the recommendations in the geotechnical report. Minimum footing burial shall be 2 m.

3.1 DESIGN

All structural designs shall be performed by or under the direct supervision of a registered Professional Engineer. The registered Professional Engineer shall seal and sign all structural design documents. Calculations shall be in SI (metric) units of measurements. Prestressed concrete girders shall be used if required to meet design loads and design spans. Where the thickness of replacement bridge structure raises the bridge wearing surface elevation above the existing pavement elevation, either the approach roadway shall be modified or the girders shall be dapped or end abutments modified or replaced to create a smooth transition between the existing highway surface and the bridge wearing surface.

3.2 STRUCTURAL EVALUATION REPORT

A Structural Evaluation Report shall be prepared under direct supervision of a registered Professional Engineer. The registered Professional Engineer shall seal and sign the Structural Evaluation Report. The Structural Evaluation Report shall provide dimensions of the existing structures which will be reused including abutments and footings, and provide recommendations for the repair of damaged existing structures and appurtenances including the abutments and bearings.

3.3 STANDARDS

The Contractor shall use the following American standards to provide structural design if local standards are not available, relevant, or applicable. Codes to be considered are the latest edition.

Concrete	ACI 318 and ASTM C 39
Steel Reinforcement	ASTM A 615
Anchor Bolts	ASTM F 1554; Grade 36 steel hot-dipped galvanized
Bolts and Studs	ASTM A 307 hot-dipped galvanized
Mortar	ASTM C 270; Type M (ultimate compressive strength of 17 MPa)

3.4 DESIGN LOADS

AASHTO loads shall be used as the minimum for the design of all structures.

3.5 WIND LOADS-NOT APPLICABLE

3.6 SEISMIC

The bridge shall be design for seismicity. Seismic design is not applicable to the reinforced concrete culvert.

3.7 REINFORCED CONCRETE

All concrete in the bridge and box-culvert bypass shall be designed and constructed in accordance with AASHTO and the rest of the reinforced concrete structures and appurtenances shall be designed and constructed in accordance with the provisions of the American Concrete Institute, Building Code Requirements for Structural Concrete, ACI 318. A minimum 28-day compressive strength of 28 MPa (4,000 psi) shall be used for design and construction of all concrete. Concrete shall have maximum water-cement ratio of 0.45. Reinforcing steel shall be deformed bars conforming to American Society for Testing and Materials publication ASTM A 615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement. Provide minimum yield strength of f_y = 420 MPa (60ksi).

No concrete shall be placed when the ambient air temperature exceeds 32 degrees C (90 degrees F) unless an appropriate chemical retardant is used. In all cases when concrete is placed at 32 degrees C (90 degrees F) or hotter it shall be covered and kept continuously wet for a minimum of 48 hours.

-END OF SECTION-